

Arm vein conduit is superior to composite prosthetic-autogenous grafts in lower extremity revascularization

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Purpose: Various alternative conduits have been used for lower extremity revascularization when an adequate ipsilateral greater saphenous vein is absent. This study compared the effectiveness of all-autogenous multisegment arm vein bypass grafts with that of composite grafts composed of combined prosthetic and autogenous conduits.

Methods: One hundred fifty-three lower extremity revascularization procedures performed between 1990 and 1998 were followed up prospectively using a computerized vascular registry. The grafts were composed of spliced arm vein segments with venovenostomy in 122 and of composite prosthetic-autogenous conduit in 31. Arm vein conduit was prepared by means of intraoperative angioscopy for valve lysis and identification of luminal abnormalities in 47.7% of cases.

Results: Bypass graft configurations were as follows: femoropopliteal (12 arm vein, 2 composite); femorotibial (75 arm vein, 23 composite); femoropedal (14 arm vein, 6 composite), and popliteo-tibial/pedal (21 arm vein, 0 composite). The indication for surgery was limb salvage in 98% and disabling claudication in 2% of cases. The mean follow-up was 25.1 months (range, 1 month to 7.9 years). Overall survival at 4 years was 51%. Overall patency and limb salvage rates were as follows: primary patency, at 1 year—arm vein, $76.9\% \pm 4.8\%$; composite, $59.5\% \pm 9.6\%$ ($P = .02$); at 3 years—arm vein, $70.0\% \pm 8.0\%$; composite, $43.7\% \pm 12.4\%$ ($P < .01$); and at 5 years—arm vein, $53.8\% \pm 8.7\%$; composite, 0%; secondary patency, at 1 year—arm vein, $77.5\% \pm 4.6\%$; composite, $59.8\% \pm 9.5\%$ ($P = .02$); at 3 years—arm vein, $70.7\% \pm 7.5\%$, composite, $44.9\% \pm 13.1\%$ ($P < .01$); at 5 years—arm vein, $57.7\% \pm 8.0\%$; composite, 0%; limb salvage, at 1 year—arm vein, $89.3\% \pm 3.7\%$; composite, $73.9\% \pm 8.9\%$ ($P < .01$); at 3 years—arm vein, $80.5\% \pm 7.0\%$; composite, $49.6\% \pm 14.3\%$ ($P < .01$); at 5 years—arm vein, $76.3\% \pm 9.9\%$; composite, 0%.

Conclusion: In this study, multisegment autogenous arm vein was used successfully in a wide variety of lower extremity revascularization procedures and achieved good long-term patency and limb salvage rates, well in excess of those achieved with composite prosthetic-autogenous grafts. The use of autogenous conduit appears to offer superior results to composite conduit in lower extremity revascularization. The superior durability of arm vein makes it one of the alternative conduits of choice when an adequate greater saphenous vein is not available. (J Vasc Surg 2000;31:1119-27.)

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Competition of interest: nil.

Presented at the Twenty-sixth Annual Meeting of the New England Society for Vascular Surgery, Chatham, Mass, Oct 1-3, 1999.

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0741-5214/2000/\$12.00 + 0 24/6/106488

doi:10.1067/mva.2000.106488

Greater saphenous vein (GSV) is the preferred conduit for infrainguinal revascularization.¹⁻¹¹ However, up to 45% of patients seen with critical lower extremity ischemia do not possess a usable ipsilateral GSV.^{1,12,13} Consequently, the question of what alternative conduit should be used in the absence of an adequate ipsilateral GSV has arisen.¹⁴ The alternative conduits may be generally divided into autogenous and non-autogenous, or prosthetic, groups. Prosthetic conduit bypass grafts to the popliteal artery have achieved moderate success.^{8,15} Prosthetic grafts to the tibial vessels have also been

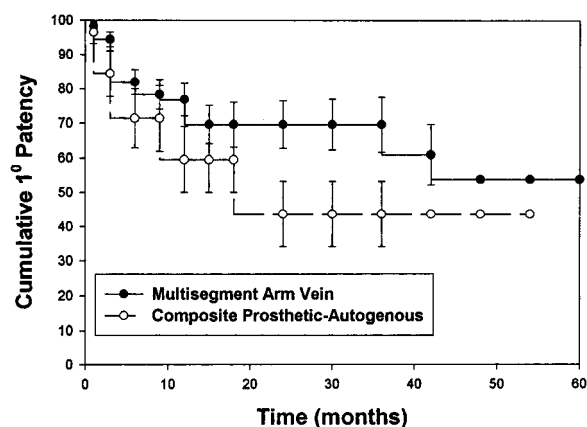


Fig 1. Life-table analysis of the variation in primary patency rates categorized by type of conduit. Multisegment arm vein grafts (solid line/solid circles) demonstrated significantly higher patency rates at all time points after 30-days compared with composite grafts (dashed line/open circles).

performed with results that justify their use as an alternative to primary amputation.¹⁶ However, the effectiveness of prosthetic grafts below the knee has been found inferior to that of all-autogenous conduits in the majority of studies. When only a short segment of autogenous vein is required for revascularization, such as in a tibiotibial bypass or a revision "jump" graft, a single segment of alternative autogenous vein may be relatively easily obtained. Alternative autogenous veins include cephalic and basilic arm vein, lesser saphenous vein, and remnants of the GSV.¹⁷⁻²⁰ Frequently, however, the length of conduit required cannot be obtained by using a single segment of alternative vein, and two or more segments must be spliced together. Some authors have expressed concern that the performance of a venovenostomy may lead to the development of intimal hyperplasia and vein graft failure.

These factors have prompted attempts to combine prosthetic and autogenous conduit to achieve a bypass graft of a length suitable for long lower extremity bypasses, while attempting to maintain the superior results achieved with all-autogenous grafts.^{10,21-24} These grafts have been placed with both sequential configurations and with primary anastomoses between the prosthetic conduit and the autogenous vein. Alternatively, modifications including placement of a cuff or a patch of autogenous vein at the distal anastomosis have been used successfully at a limited number of institutions.²⁵ This study examined the effects of conduit type on the outcome of long-length infrainguinal arterial recon-

Table I. Patient demographics

Characteristic	Arm vein (%)	Composite (%)
Male	66	64
Diabetes	83	90
History of recent smoking	78	74
CAD	63	71
Previous CABG or PTCA	41	48
Hypertension	64	68
ESRD	15	10
Average age (y)	72.4	68.1

CAD, Coronary artery disease; CABG, coronary artery bypass grafting; PTCA, percutaneous transluminal coronary angioplasty; ESRD, end-stage renal disease.

Table II. Anatomic configuration of revascularization procedure

Graft configuration	Arm vein no. (%)	Composite no. (%)
Femoropopliteal	12 (9.8)	2 (6.5)
Femorotibial	75 (61.5)	23 (74.2)
Femoropedal	14 (11.5)	6 (19.4)
Popliteo-tibial/pedal	21 (17.2)	0

structive procedures. Conduits composed of two or more segments of autogenous arm vein spliced together were compared with composite conduits composed of prosthetic graft material proximally and autogenous vein distally.

PATIENTS AND METHODS

Database and patient demographics. From January 1, 1990, to August 31, 1998, a consecutive series of 3019 infrainguinal arterial reconstructions were performed. All data regarding each patient, procedure, and follow-up were entered prospectively in a computerized vascular registry. These data were then reviewed retrospectively. During this time, 122 bypass procedures were performed using multiple segments of arm vein with venovenostomy. In addition, 31 procedures were performed using composite graft composed of prosthetic conduit proximally (24 polytetrafluoroethylene [PTFE], 7 Dacron) and autogenous vein distally. The demographics of the 153 patients are shown in Table I. All procedures were performed in the absence of an adequate ipsilateral GSV. Prosthetic conduit was used when adequate autogenous conduit was unavailable. The majority (150, 98%) of the revascularization procedures were performed for limb salvage, including gangrene in 39 (25.5%), ischemic ulcer in 93 (60.8%), and ischemic rest pain in 18

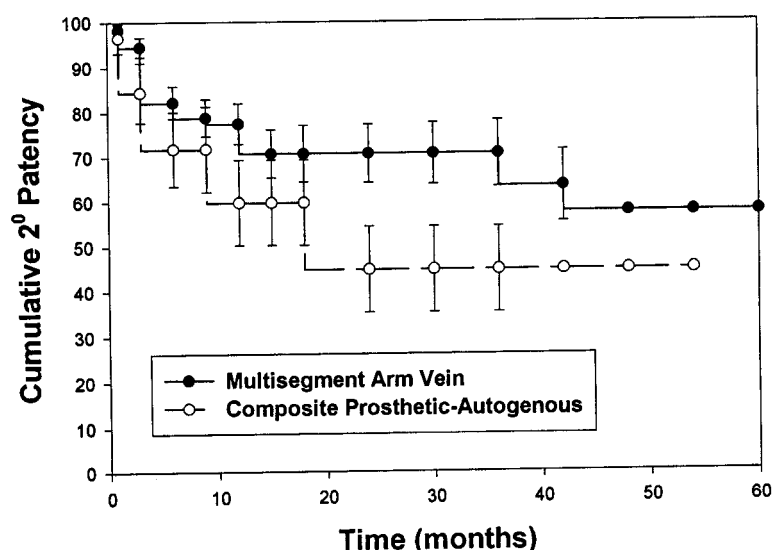


Fig 2. Life-table analysis of the variation in secondary patency rates categorized by type of conduit. Again, multisegment arm vein grafts (solid line/solid circles) were superior to composite grafts (dashed line/open circles).

(11.8%). Only 3 (2%) revascularizations were performed for treatment of disabling claudication. Bypass was performed as the initial procedure in 60 (49.2%) arm vein cases and 12 (38.7%) composite cases and as redo bypass procedures in 64 (50.8%) arm vein cases and 19 (61.3%) composite cases. Twelve grafts were composite sequential, and 19 were in-line composite or shared a common ostium. There was no crossover between groups. The definitions and classification of all criteria used were those recommended by the Ad Hoc Committee on Reporting Standards, SVS/NA-ISCVS.²⁶

Vein graft preparation. After harvest through continuous upper extremity incisions, the arm vein was maintained in cooled balanced salt solution to preserve vessel wall integrity, as described previously.^{13,27} During 47.7% of the procedures, angiography was used to assess the luminal characteristics of the arm vein and perform valve lysis.²⁸ Angiography was not performed in instances in which the arm vein was used in the reversed configuration or if short vein segments were used in which valve lysis could be performed under direct visualization. Angioscopes ranged in size from 0.8 to 2.2 mm in outer diameter (Olympus Corp, Lake Success, NY). Abnormalities were corrected either externally (vein patch angioplasty) or by using angioscopic guidance (removal of adherent thrombus, lysis of endoluminal strands). Alternatively, resection of the abnormal segments was performed when repair was not possible (vein sclerosis).

Venovenostomies were performed end-to-end by using 7-0 polypropylene suture (Prolene; Ethicon, Sommerville, NJ) to create a vein conduit of sufficient length and quality to allow performance of the lower extremity revascularization. Anastomoses between prosthetic grafts and autogenous vein were performed with CV-7 polytetrafluoroethylene suture (W. L. Gore, Flagstaff, Ariz) or 6-0 polypropylene suture. The specific arterial reconstructive procedures performed are listed in Table II.

Postoperative follow-up. During the first year, patients were followed up with office visits every 3 months; visits were every 6 months thereafter. Graft patency was determined by means of clinical examination of pulses distal to the bypass graft, as well as by continuous-wave Doppler examination. Selective color-flow duplex examination was also performed to determine graft patency or define flow abnormalities. The criteria for patency and the definitions of primary, assisted primary, and secondary patency, limb salvage, and survival rates used in this study are those outlined by the Ad Hoc Committee on Reporting Standards, SVS/NA-ISCVS.²⁶ Follow-up ranged from 1 month to 7.9 years, with an average follow-up of 25.1 months.

Statistical analysis. Life-table analysis was used to calculate patency, limb salvage, and survival rates. Comparison between life-table curves was performed by using the Mantel-Cox log-rank test for significance. Figures are represented as the mean \pm standard error. Other continuous variables were

Table III. Morbidity and mortality

Complication	Type	Arm vein no. (%)	Composite no. (%)
Local complications	Hematoma	9 (7.4)	3 (9.7)
	Wound infection	2 (1.6)	0 (0)
	Wound dehiscence	1 (0.8)	0 (0)
	Hemorrhage	1 (0.8)	0 (0)
	Graft infection	0 (0)	1 (3.2)
Systemic complications	Myocardial infarction	3 (2.5)	2 (6.4)
	Renal failure	1 (0.8)	0 (0)
	Pulmonary failure	3 (2.5)	0 (0)
	Pneumonia	7 (5.7)	2 (6.4)
30-day mortality		3 (2.5)	1 (3.2)

compared with the Student *t* test, and discrete parameters were compared using chi-squared analysis. Significance was assumed at *P* less than .05.

RESULTS

Morbidity and mortality. The overall perioperative systemic morbidity rate was 11.5% for arm vein graft procedures and 12.9% for composite graft procedures (*P* = NS). The perioperative local complication rates were 11.5% and 12.8%, respectively (*P* = NS). Complications—including myocardial infarction, pulmonary failure necessitating intubation, renal failure requiring dialysis, pneumonia, hematoma, wound infection, graft infection, and wound dehiscence—did not differ significantly between groups (Table III). A return to the operating room was required for 6 patients (3.9%). The 30-day mortality rate was 2.5% for arm vein procedures and 3.2% for composite procedures (*P* = NS). This was not significantly different from the rate for all lower extremity revascularization procedures at our institution during the same period. Morbidity resulting from arm vein harvest occurred in 2 patients (1.6%). This consisted of numbness involving the volar aspect of the forearm.

Graft patency, limb salvage, and survival. Cumulative patency and limb salvage rates for multisegment arm vein conduit were superior to those observed for composite prosthetic-autogenous conduits. Primary patency is depicted in Fig 1. Primary patency for multisegment arm vein grafts was greater than that of composite grafts at all time points after 30 days. The 3-year rates were as follows: arm vein, 70.0% ± 8.0%; composite, 43.7% ± 12.4% (*P* < .01) (of note, results beyond 3 years for the composite group have a standard error that exceeds 10% (Fig 1). Similarly, the cumulative secondary patency rates were significantly higher for multisegment arm vein grafts compared with composite grafts (Fig 2). The

3-year secondary patency rates were as follows: arm vein, 70.7% ± 7.5%; composite, 44.9% ± 13.1% (*P* < .01). Only small differences were observed between the primary and the secondary patency rates, and no significant difference was observed based on the number of venovenostomies performed. Limb salvage rates demonstrated the greatest difference, with multisegment arm vein conduit again being superior by log-rank analysis (3-year, 80.5% ± 7.0%, vs 49.6% ± 14.3%, *P* < .01) (Fig 3).

Multisegment arm vein grafts demonstrated higher patency and limb salvage rates in all graft configurations (femoropopliteal, femorotibial, femoropedal). Cumulative patency and limb salvage were greater for femoropopliteal and femorotibial grafts than for femoropedal grafts. The femorotibial configuration comprised the greatest proportion of bypass grafts (arm vein, 75/122 (61.5%); composite, 23/31 (74.2%). The 4-year primary/secondary/limb salvage rates for femorotibial grafts were as follows: arm vein, 58.0% ± 10.3%/59.0% ± 9.6%/83.6% ± 8.5%; composite, 42.4% ± 12.1%/42.4% ± 12.1%/46.9% ± 13.3% (Fig 4). Overall survival was 51% at 4 years.

Lower extremity revascularization was performed as the initial procedure in 60 (49.2%) arm vein cases and in 12 (38.7%) composite cases and as a revision procedure in 64 (51.8%) arm vein cases and in 19 (61.3%) composite cases. No significant difference was present between primary and redo procedures.

DISCUSSION

Progressive improvement in vascular surgical methods and practice has led to increased limb preservation and reduced rates of lower extremity amputation.²⁹⁻³¹ Numerous reports from multiple institutions have confirmed the effectiveness of infrainguinal revascularization in producing superior long-term patency and limb salvage rates.¹⁻⁹

However, the need for alternative conduits for lower extremity revascularization has become increasingly evident, particularly when multiple procedures are performed to salvage a single extremity.

The first use of arm vein as an alternative conduit for lower extremity revascularization was reported in 1969.³² The effectiveness of arm vein for lower extremity revascularization was confirmed by several subsequent reports.^{20,33} Excellent long-term patency and limb salvage rates have recently been shown in several studies involving large numbers of patients who underwent infrainguinal revascularization with arm vein conduit.^{13,34} Indeed, 5-year cumulative patency and limb salvage rates up to 57.5 and 71.5%, respectively, make arm vein an excellent alternative when the GSV is not available for use.

Nevertheless, concern regarding the use of arm vein for infrainguinal reconstructions has been expressed, particularly when it is necessary to anastomose multiple segments of vein to create a conduit of adequate length for long-length bypass grafts.^{14,35} These concerns, and questions regarding the ability to obtain adequate lengths of arm vein conduit, have led several authors to propose the use of composite grafts composed of prosthetic conduit and autogenous vein.²¹⁻²⁴ Two-year primary patency rates between 29% and 35% are reported with the use of these composite grafts.^{22,24} These results are consistent with those observed in the present study. Reports have come from some centers of excellence in vascular surgery describing good results with the use of prosthetic grafts alone, and these authors have noted that these bypass procedures provide a better alternative than primary amputation.¹⁶ Additionally, it has been noted that the harvesting of arm vein requires for a significantly greater effort than using prosthetic grafts, and that a correspondingly significant increase in patency and limb salvage should be achieved to justify such efforts.¹⁴ In an attempt to determine the optimal alternative conduit for lower extremity revascularization, we have compared the results of bypass procedures performed using all-autogenous bypass grafts composed of multiple segments of arm vein with the results obtained using composite prosthetic-autogenous grafts. In doing so, we hoped to guide our future selection of alternative conduit in the difficult clinical situation in which the GSV is not available.

In the experience reported in this study with the use of these two conduit types over the last 7 years, it appears that arm vein, even when spliced together with venovenostomy, results in superior clinical outcomes. In this study, multisegment arm vein grafts demonstrated significantly better primary and sec-

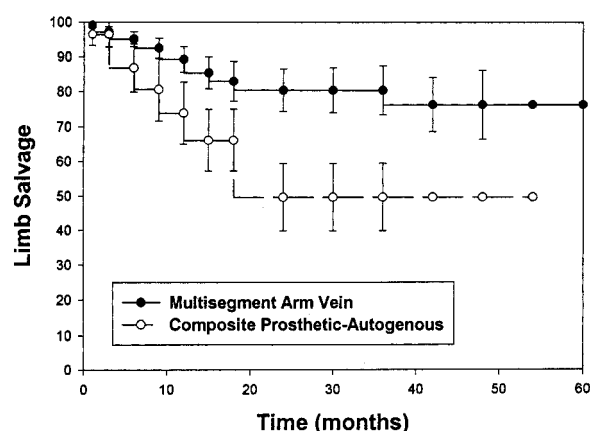


Fig 3. Life-table analysis of the variation in limb salvage categorized by type of conduit. Limb salvage rates demonstrate the greatest difference, with multisegment arm vein grafts (solid line/solid circles) again being higher than composite grafts (dashed line/open circles).

ondary patency, as well as limb salvage, in both short- and long-term follow-up studies. Arm vein proved superior regardless of bypass configuration, and its effectiveness was not significantly diminished in revision bypass procedures. In addition, the use of arm vein did not lead to any increase in morbidity or mortality in a patient population with considerable comorbidities. Arm vein may also have the additional potential advantage of a decreased susceptibility to infection as compared with composite grafts containing prosthetic material, although this was not shown to be significant in this study.³⁶

Several published reports have advocated the use of composite prosthetic-autogenous grafts for lower extremity revascularization.^{11,21-24} The procedures were most frequently performed, as they were in this trial, for limb salvage. The bypasses generally required use of the tibial vessels for the distal anastomosis, again consistent with this report. Three-year cumulative patency rates between 20% and 35% are most frequently reported.²²⁻²⁴ In occasional instances, the 3-year primary patency has been reported to be as high as 53%.²³ These rates are comparable with those described in this report for composite sequential grafts—3-year primary, 43.7%; limb salvage, 49.6%. These rates are significantly lower than those achieved with multisegment arm vein conduit. It is also worth noting that occasionally these authors observed a persistently patent

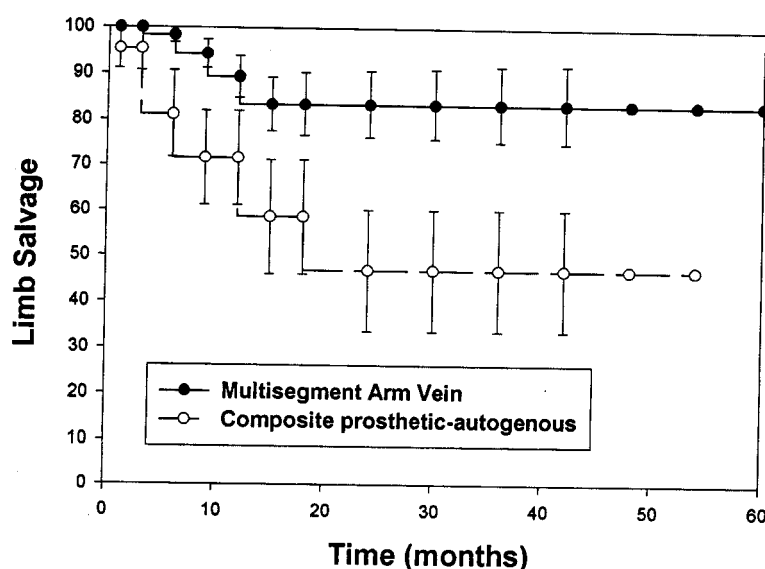


Fig 4. Life-table analysis of limb salvage in femorotibial grafts categorized by conduit type. Multisegment arm vein conduit (solid line/solid circles) demonstrated greater limb salvage rates than did composite conduit (dashed line/open circles) in all graft configurations. Primary and secondary patency rates were also greater for arm vein grafts.

venous segment after thrombosis of the prosthetic component of composite sequential grafts.²¹ This was noted in two of the sequential composite grafts in this study. These findings provide further support for the preferential use of autogenous conduit in lower extremity revascularization.

The use of an all-autogenous conduit appears to be the most important factor in achieving the highest patency and limb salvage rates when it is necessary to use conduit other than the GSV. Alternatives to arm vein that have been proposed include the lesser saphenous vein (LSV) and remnants of the GSV.^{12,18,19} With the use of these alternative autogenous vein conduits, high long-term patency and limb salvage rates have been achieved. And, although harvest of the LSV may require placement of the patient in the prone position with subsequent repositioning to the supine position for performance of the bypass procedure, use of the LSV for lower extremity revascularization without repositioning has been reported. Thus, use of the LSV and GSV remnant provides a favorable alternative when the ipsilateral GSV is not of sufficient length or quality.

It was not unexpected that greater than half of the revascularization procedures in this study were performed as revision, or "redo," procedures since in the majority of patients the absence of a suitable ipsilateral GSV was attributable to its use for a previous bypass performed on that limb. This may high-

light the value of preserving the contralateral GSV when possible. Interestingly, although primary procedures showed a slight trend toward improved patency, the difference was small and not statistically significant. This finding may reflect a relatively unfavorable arterial anatomy present in patients requiring arm vein bypass as a primary revascularization procedure.

In previous studies from this institution, primary and secondary patency and limb salvage rates of multiple segment arm vein grafts were indistinguishable from those of single-segment grafts. This is likely the result of the fact that the site of venovenostomy was not significantly prone to stenosis and graft failure in this study. Rather, bypass graft failure most frequently resulted from progression of atherosclerotic disease in the native arteries. Additionally, the progression of intrinsic lesions within the vein graft may lead to bypass graft failure. Chang et al³⁷ have reported their extensive experience with spliced vein bypasses for infrainguinal arterial reconstruction. They also obtained excellent long-term patency (4 years, 61%) and limb salvage (4 years, 85%-90%) rates. Therefore, the need for multiple vein segments and venovenostomies should not discourage the use of these shorter vein segments.

In conclusion, several alternative conduit options are available for use when an adequate ipsilateral GSV is absent. The use of all-autogenous grafts

when an alternative conduit is required appears to provide the best results with regard to long-term patency and limb salvage. With the use of alternative autogenous vein conduits, however, it may often be necessary to anastomose together 2 or more vein segments. Though stenosis at the venovenostomy site is a concern, this study demonstrates that the use of multisegment arm vein grafts results in outcomes that are clearly superior to those obtained by using composite grafts composed of a combination of prosthetic and autogenous material. The use of arm vein as the first alternative for lower extremity revascularization when the GSV is not available, as reported here, has resulted in long-term patency and limb salvage rates that meet or exceed those reported for other alternative conduits, while preserving the contralateral GSV for subsequent use. In addition, these patency and limb salvage rates were achieved without a significant increase in morbidity or mortality in a patient population with extensive comorbid conditions.

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Submitted Oct 7, 1999; accepted Jan 10, 2000.

DISCUSSION

Dr LaMuraglia (Boston, Mass). I enjoyed your paper. Thank you very much. I think that we all agree that all autogenous conduit, especially for these distal reconstructions, is very important. The one thing I would like to ask is when you discuss your issue of a composite, are you primarily discussing a composite using a prosthetic graft going to a vein without a composite sequential configuration, or have efforts been done to try to perform the composite sequential by going to maybe an isolated popliteal segment with the composite and then using a segment of cephalic or other vein to go to the tibial to improve the runoff to the foot, which is necessary in a lot of these patients for limb salvage. The data in the past have shown that composite sequentials are actually far superior in terms of long-term patency than regular composite.

Dr Faries (Boston, Mass). In this study of the 31 composite grafts, 12 were performed in the sequential configuration in which a prosthetic graft was taken to an isolated arterial segment, and an autogenous vein was then used either from a combined anastomosis or from further distally on that segment for the tibial or pedal revascularization. In 10 cases a common ostium anastomosis was used, and in seven cases a direct anastomosis between the composite conduit and the arm vein was performed. Interestingly, in two of the patients who had the sequential configuration, failure of the prosthetic component occurred while the venous component remained patent in those patients.

Dr Conte (Boston, Mass). Peter, I congratulate you on your presentation and also on the outstanding results that your group has shown with arm vein conduits. I rise just to ask about the contralateral saphenous vein issue that I think continues to puzzle me a little bit. I think numerous reports have now established that the incidence of requiring it subsequently for coronary bypass is fairly low, probably because the diseases occur at a different time in the average patient's life span. What percentage of your

patients had contralateral saphenous vein available, and then how many went on to actually need it for something else? In what situations do you entertain using contralateral saphenous vein?

Dr Faries. Rarely do we entertain using the contralateral saphenous vein, and I think that is because our patient population exhibits a number of the factors that would make its use for contralateral lower extremity revascularization more likely in follow-up. These factors have been elucidated nicely by the Dartmouth group and include the existence of a low ABI in the contralateral side, the presence of diabetes, and the presence of coronary artery disease. In addition, in our patients 46% of those patients at the time of presentation do not possess a contralateral greater saphenous vein that is usable, and in follow-up of those patients who did possess it, 23% ultimately needed revascularization of the contralateral side. This was with a mean follow-up of 14.9 months, so a significant proportion of those patients in our patient population will ultimately require revascularization of the contralateral side. I think that would vary from population to population, and specific vascular centers should determine the likelihood of contralateral lower extremity revascularization in their patients individually.

Dr Conte. Was that predictable, though? I mean, if you had a patient who had a relatively good ABI in the other leg, would you ever consider using that vein?

Dr Faries. The contralateral saphenous vein has been used at our center, and the decision to use it is made by the operating surgeon.

Dr Darling (Albany, NY). Dr Faries, again that was another superb paper presented by you from the Deaconess group. Like most of us here we have all been privileged with performing many spliced vein reconstructions. In the last 450 splice vein reconstructions that we have performed, we have had to alter our surveillance of

these bypasses because of the fact that about 20% of them will have a stenosis revised possibly because of using disadvantaged conduits for these spliced vein reconstructions. Have you altered your surveillance protocol for these as opposed to the single segment veins?

Dr Faries. Our follow-up protocol is slightly different. We are more aggressive in terms of imaging these patients with duplex ultrasonography. We do not necessarily use duplex ultrasonography in all patients with revascularization procedures, but our threshold for performing that in follow-up is lower in these spliced arm vein segment patients.

Unidentified Speaker. Peter, that was a very nice paper and thanks for bringing us a contemporary series of composite grafts. In the old days people would say that when you had composite grafts vein plus plastic that the overall patency would revert to that of the prosthetic graft. Is that pretty much what you think is going on here?

Dr Faries. These composite grafts demonstrate a slightly greater patency in limb salvage rates than primary prosthetic grafts to tibial vessels, at least in the majority of series and in the randomized trials, multicenter trials. So it may be slightly better than prosthetic alone, although some authors, particularly Dr Pappas and Dr Hobson in New Jersey, have reported superior patency rates with tibial vessel bypass grafts performed using a vein cuff.

Unidentified Speaker. Another question if I may. It has also been touted that once you manipulate a vein in any way—you patch it, you splice it—that that has a really significant negative impact on patency. How do your data compare with a contemporary series of unmanipulated vein grafts?

Dr Faries. We have compared with our patients this series of patients who required only a single segment of arm vein to perform their bypass. In the overall patency rates there was no significant difference, and no difference was present in the limb salvage rates. It may be the threat of intimal hyperplasia at the venovenostomy is not as

significant as we had thought it would be, since in over 520 procedures we did not determine a significant difference between single segment and multisegment arm vein grafts.

Dr Cronenwett (Lebanon, NH). Peter, I enjoyed this also. Although my biases support your conclusion that these composite vein grafts are better, another interpretation of your data would be that since these composite prosthetic vein grafts had to be used more often in the redo scenario, you showed a nice graph that showed in the redo situation there was no difference. So then would not an alternate explanation be that the redo nature of the procedure explains the result, rather than the nature of the conduit.

Dr Faries. There was no significant difference in terms of primary versus redo procedures between multisegment arm vein grafts and composite prosthetic-autogenous grafts. We have not analyzed the data on the basis of that factor alone, but it does not appear to account for the marked differences observed between these two types of arterial conduits.

Dr Jackson (Northampton, Mass). I wondered in your venovenostomy the technique that you use. Do you suture or do you use the extrusion vascular clip technique?

Dr Faries. 7-0 Prolene sutures are used for the venovenostomy.

Dr Cambria (Boston, Mass). Peter, nice paper. One comment and one question. I think it is fair to say that your data, with respect to the equivalent performance of multiple splice vein grafts as opposed to a single conduit, are certainly different than reported by some others. My question relates to your adjunctive treatment of patients with disadvantaged prosthetic autogenous composite conduits. What is your policy about anticoagulation in these patients, and do you think that might make a difference?

Dr Faries. Anticoagulation is most typically used for prosthetic grafts that extend below the knee in any configuration. These patients receive long-term anticoagulation with Coumadin.